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THE BETATRON AT THE INSTITUTE OF ATOMIC PHYSICS OF THE RUMANIAN ACADEMY OF SCIENCES

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THE BETATRON AT THE INSTITUTE OF ATOMIC PHYSICS OF THE RUMANIAN ACADEMY OF SCIENCES

[Following is a translation of an article by engineer C. Iliescu, of the Institute of Atomic Physics, appearing in Tehnica Noua, Vol 9, No 52, 26 Dec 62, Bucharest, pp 1,3.]

Studies of increasing complexity are being undertaken in experimental nuclear physics, aimed at finding new ingenious solutions from the theoretical, practical and economic viewpoints and at making new contributions to science. In order to carry out these studies, highly technical devices have been built, among which are the particle accelerators. One of the growing variety of types of accelerating machines is the betatron, an installation with multiple possibilities. Such an installation has been built and is functioning in our country within the framework of the Institute of Atomic Physics of the Academy of the R.P.R. The betatron (see photograph on page 3) has been completely designed and built by a collective of researchers of the Institute of Atomic Physics, with the aid of some of our industrial enterprise

Alongside the reactor and the cyclotron – built with the hel of the Soviet Union – and other basic equipment, the betatron wil be used by our researchers to begin work in some specific areas of unusual interest and actuality in nuclear physics and to initiate industrial applications of similar great actuality concerning non-destructive control of thick metallic parts, or applications in medicine, especially in the fight against cancer tumors.

The Rumanian betatron began to function on 20 August 1959.

The main part of the betatron is an electromagnet weighing approximately 3 tons. The "heart" of the accelerator is the acceleration chamber, made of porcelain, which is placed between the polar pieces of the electromagnet.

In the interior of this chamber, which has almost the shape of a toroid, the pressure is kept very low, approximately one mil liard times lower than atmospheric pressure. Here takes place the "journey" of the electrons, which are hurled in 50 times per second by means of an electron gun. In the course of their journey, which lasts only five thousandths of a second, the electrons reac a speed very close to that of light and execute one million revolutions, thus traveling 1500 km. In the end they are forced to collide with a target of heavy metal, producing high energy Roen

gen braking radiation. The Roentgen rays pass easily through the walls of the acceleration chamber and, as they leave the betatron, can be used for research or applications.

At present, the maximum energy of the Roentgen rays is 25 million eV, and the intensity measured at a distance of 1 meter from the target is 42 Roentgen per minute.

The betatron of the Institute of Atomic Physics is, through design and purpose, a research betatron, its main function being to help in nuclear physics research. This research has already begun. It concerns the study of photonuclear reactions which furnish important information on the structure of the nucleus and the production of radioactive isotopes for studies in nuclear spectroscopy.

The penetrating radiation of the betatron, which goes through matter easily and leaves a picture on the photographic plate, makes possible the X-raying of heavy metal pieces up to a thickness of one half meter. The pictures are clear and the hidden flaws of the piece, if there are any, can thus be identified, and the exposure time is not too long. For steel parts with thickness up to 70-80 mm it is possible to use Roentgen rays of 300 keV of the familiar Roentgen installations.

The use of radioactive isotopes and especially of cobalt 60 allows almost the doubling of this limit. Beyond 120-150 mm the control of heavy pieces through radiography is only possible by

means of the high energy radiation generated by the betatron.

Although our betatron is not especially designed for the work of non-destructive flaw-detecting radiograpny, it was used for this purpose too, in order to gain experience in perfecting the radiography method and to answer the requests received from industry.

With the development of our industry's ability to build thermo-energy machines and chemical, petroleum and other installations, and with the uninterrupted raising of the technical level and the quality of these products, along the lines indicated by party and state documents, the role and the importance of the betatrons in the non-destructive control of thick metallic pieces will become increasingly greater.

At the recent international conference on the construction and use of betatrons, held in November 1962 at Bucharest, the participants from five foreign countries learned of the achievements of our specialists in this field. In the papers of this conference there is much appreciation for the quality of the installation as well as the research work presented by the Rumanian delegation.

The achievements of the researchers from the Institute of Atomic Physics, who have built and are using the betatron, are the result of the unselfish work of this collective, which is pursuing its activity under completely new conditions, that have been provided for scientific research in our country by the party

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